

**REMARKS****INTRODUCTION:**

In accordance with the foregoing, claim 3 has been amended, and claims 11-12 have been added. No new matter is being presented, and approval and entry are respectfully requested.

Claims 1-12 are pending and under consideration. Reconsideration is respectfully requested.

**CHANGES TO THE SPECIFICATION:**

The specification has been reviewed in response to this Office Action. Changes have been made to the specification only to place it in preferred and better U.S. form for issuance and to resolve the Examiner's objections raised in the Office Action. No new matter has been added.

Paragraphs [0116], [0118] and [0121], together with Table 1 have been amended to correct the spelling of "Yumex" to ---Umex---.

**REJECTION UNDER 35 U.S.C. §102 and/or §103:**

In the Office Action, at pages 3-4, numbered paragraph 4, claims 1, 2, 4-6, 8 and 10 were rejected under 35 U.S.C. §102(b) as anticipated by or, in the alternative, under 35 U.S.C. §103(a) as obvious over Mehta et al. (USPN 6,844,389; hereafter, Mehta). The reasons for the rejection are set forth in the Office Action and therefore not repeated. The rejection is traversed and reconsideration is requested.

It should be noted that U.S. Patent no. 6,844,389 to Mehta et al. issued after the present application was filed in the U.S. However, before Mehta issued as a patent, the Mehta et al. application was published on July 10, 2003.

It is respectfully submitted that the invention recited in independent claim 1 of the present application relates to a polyolefin resin composition comprising a modified polyolefin resin having a specific carboxylic acid modification degree (Pc1) and a specific hydrogen bonding carboxyl modification degree (PcH), modified layered silicate, and polyolefin resin.

The polyolefin resin composition of the present invention exhibits far more improved heat resistance and flame retardancy compared to the conventional resin compositions prepared by dispersing a modified layered silicate with a compatibilizing agent (see paragraph [0007] of the published Patent Application No. 20050239941).

According to the present invention, high heat resistance and flame retardancy is achieved by adjusting Pcl and Pch of a modified polyolefin resin to a specific range, that is, by increasing the proportion of the carbonyl group in the modified polyolefin resin (see paragraph [0044] of the published Patent Application No. 20050239941 and Examples).

The modified polyolefin resins preferably used in the present invention include maleic acid modified polyolefin such as HW2203A and HW1105A (see paragraph [0062] of the published Patent Application No. 20050239941).

In contrast, US Patent No. 6,844,389 (hereafter, Mehta) relates to an ethylene polymer composite comprising a base polymer, an organically modified clay and a compatibilizing agent. The ethylene polymer composite is improved in melt strength and physical properties (see Mehta, column 3, lines 29-37).

As a useful compatibilizing agent, Mehta describes the following compounds at column 6, lines 5-13:

- (a) ethylene-vinyl carboxylate copolymers, and
- (b) polymers of ethylene having about 0.1 to 8 wt.% ethylenically unsaturated carboxylic acid or derivative monomer copolymerized or grafted

The compatibilizing agent (a) comprises ethylene vinyl acetate (EVA) copolymers having a vinyl acetate content from 8 to 35 wt.%, which copolymers are particularly useful compatibilizers (see Mehta, column 6, lines 14-20). Therefore, in Examples 2 and 3 of Mehta, EVA copolymers with a vinyl acetate content of 19% and 28%, respectively, were employed.

The compatibilizing agent (b) comprises ethylene polymer compatibilizers modified by polymerizing or grafting using an ethylenically unsaturated carboxylic acid or acid derivative monomer (see Mehta, column 6, lines 21-25). For the compatibilizing agent (b), a compatibilizing agent having a maleic anhydride content of 0.2 to 4 wt.% is exemplified as a preferred one (see Mehta, column 6, lines 39-50). In Example 1, polyethylene resin (HDPE) grafted with 2 % maleic anhydride was employed.

Mehta exemplifies compatibilizers modified with various acids as the compatibilizing agent (b). The compatibilizing agents used in the present invention (e.g., maleic acid modified compatibilizer) are included in those exemplified in Mehta. However, the preferred compatibilizer in Mehta is different from that described in the present application. Differences are specifically described below.

The Examiner has admitted: Mehta et al. does not disclose the spectral properties of HDPE-g-MA or EVA modified polyolefins..” The court has held “that the [claimed] range is critical, generally

by showing that the claimed range achieves unexpected results relative to the prior art range.” In re Geisler, 116 F.3d at 1469-70, 43 USPQ2d at 1365 (alteration in original) (quoting In re Woodruff, 919 F.2d at 1578, 16 USPQ2d at 1936) (Fed. Cir. 1990). In re Wertheim, 541 F.2d 257, 267, 191 USPQ 90, 100 (CCPA 1976) (recognizing that “ranges which overlap or lie inside ranges disclosed by the prior art may be patentable if the applicant can show criticality in the claimed range by evidence of unexpected results” (emphasis added)).

It should be noted that the following unexpected results are obtained: the PcH value of EVA used in Examples of Mehta is nearly 0, while that of the modified polyolefin resin of the present invention is 0.80 or more. This appears to be due to the fact that no carboxyl groups exist in the EVA. Further, since the polyolefin used in the Examples of Mehta is modified with carboxylic anhydride, its PcH value is lower than the prescribed value 0.8 in the present application. This is supported by the fact that the polyolefin resins employed in Comparative Examples 3 and 5 of the present application which are modified with carboxylic anhydride as is done in Mehta, have lower PcH values that are less than 0.80 (see Comparative Table below). Accordingly, as shown in Table 1 of the present application, the use of the presently claimed invention provides results that are unexpectedly good.

COMPARATIVE TABLE

		Maleic Anhydride Content (mmol/g)	Pc1	PcH
Mehta	Compatibilizing agent of Example 1	0.2 <sup>*1</sup>	>0.1 <sup>*3</sup>	<0.80 <sup>*3</sup>
Comp.Ex. 3	Umex 1010	0.46 <sup>*2</sup>	0.296	0.25
Comp.Ex. 5	Umex 1001	0.23 <sup>*2</sup>	0.181	0.65

NOTE: \*1 Calculated from maleic anhydride content of 2 wt. %

\*2 Value described in JP-A-10-183892

\*3 Estimated from the values obtained in Comparative Examples 3 and 5

As explained above, the modified polyolefin resin of the present invention necessarily contains a carboxyl group in an amount specified by Pc1 and PcH. Accordingly, the modified polyolefin of Mehta having Pc1 and PcH values outside the range prescribed in the present invention differs from the modified polyolefin resin disclosed in the present invention.

By using a modified polyolefin resin with a specific range of Pc1 and PcH values, the dispersibility of the modified layered silicate is improved in the present invention, resulting in remarkable enhancement of thermal resistance and flame retardancy. This is proved by comparing

flame retardancy of the polyolefin resin compositions of Examples 1 and 2 with those of Comparative Examples 3 and 5, all of which contain the same modified silicate. The resin composition containing a compatibilizing agent preferably used in the present invention exhibits the most excellent flame retardancy at a heat release rate (HRR) of 650, while a resin composition containing the compatibilizing agent of Mehta exhibits flame retardancy at a HRR higher than 650, 800 and 850. The lower HRR value means that the flame retardancy of the resin composition is greatly improved. Specifically, as seen from Examples and Comparative Examples of the present invention, the resin composition of the present invention exhibits a heat distortion temperature of 90°C or higher (see Examples 1-5), while that containing a modified polyolefin corresponding to the compatibilizing agent of Mehta with Pc1 and PcH values outside the range prescribed in the present invention exhibits a heat distortion temperature of lower than 85°C (see Comparative Examples 3 and 5). This indicates that the resin composition of the present invention is drastically improved in thermal resistance. With a heat distortion temperature of 90°C or higher, a resin composition would be applicable to a material for dishes for hot drinks and an interior material for vehicles.

	Modified polyolefin resin	Pc1	PcH	HRR	Heat distortion temp
Ex. 1	HW2203A	0.058	0.88	650	≥90°C
Ex. 2	HW1105A	0.095	0.92	650	≥90°C
Comp.Ex. 3	Umex* <sup>1</sup> 1010	0.296	0.25	850	<85°C
Comp.Ex. 5	Umex* <sup>1</sup> 1001	0.181	0.65	800	<85°C

NOTE: \*1 Spelled "Yumex" in the present specification, but correctly "Umex"

In Mehta, there is no specific description about the modified polyolefin recited in the claims. In addition, Mehta neither teaches nor suggests that thermal resistance and flame retardancy are improved by adjusting the carboxylic acid modification degree (Pc1) and the hydrogen bonding carboxyl modification degree (PcH) to specific ranges.

Hence, Mehta does not teach or suggest claim 1 of the present invention.

In addition, it is respectfully submitted that the claimed Pc1 range and PcH range of claim 1 of the present invention achieves unexpected results relative to the ranges set forth in Mehta.

Thus, claim 1 is submitted not to be anticipated under 35 U.S.C. §102(b) by Mehta et al. (USPN 6,844,389) and to be patentable under 35 U.S.C. §103(a) over Mehta et al. (USPN 6,844,389). Since claims 2, 4-6, 8 and 10 depend from independent claim 1 of the present invention, claims 2, 4-6, 8 and 10 are not anticipated under 35 U.S.C. §102(b) by Mehta et al. (USPN 6,844,389) and are patentable under 35 U.S.C. §103(a) over Mehta et al. (USPN

6,844,389) for at least the reasons independent claim 1 is not anticipated under 35 U.S.C. §102(b) by Mehta et al. (USPN 6,844,389) and is patentable under 35 U.S.C. §103(a) over Mehta et al. (USPN 6,844,389).

**B.** In the Office Action, at page 4, numbered paragraph 5, claims 1-10 were rejected under 35 U.S.C. §103(a) as being unpatentable over Dontula et al. (USPN 6,841,226; hereafter, Dontula) in view of Mehta et al. (USPN 6,844,389; hereafter, Mehta). The reasons for the rejection are set forth in the Office Action and therefore not repeated. The rejection is traversed and reconsideration is requested.

An important feature required for a compatibilizing agent is to exhibit high compatibility with a base polymer and high interaction with a clay. In view of the compatibility with a base polymer, compatibilizing agents without polarity are preferred. Therefore, the conventional acid anhydride is more preferably employed than the carboxylic acid-containing compatibilizing agent of the present invention. While, in view of interaction with a clay, it is necessary for a compatibilizing agent to contain polar groups. However, a compatibilizing agent having too high a polarity has an adverse affect, and therefore an adequate polarity is required.

Dontula discloses improving dispersibility of a filler by incorporating a modified layered silicate into polyethylene. However, Dontula neither teaches nor suggests further improvement of dispersibility by adding a compatibilizing agent in order to enhance thermal resistance. As explained above, Mehta does not teach the use of the modified polyolefin specified in the claims. Therefore, even if Mehta and Dontula were combined, the resin composition of the present invention, which contains a specific modified polyolefin resin as a compatibilizing agent, would not be achieved.

Hence, it is respectfully submitted that independent claim 1 is patentable under 35 U.S.C. §103(a) over Dontula et al. (USPN 6,841,226) in view of Mehta et al. (USPN 6,844,389), alone or in combination. Since claims 2-10 depend from independent claim 1, claims 2-10 are patentable under 35 U.S.C. §103(a) over Dontula et al. (USPN 6,841,226) in view of Mehta et al. (USPN 6,844,389), alone or in combination, for at least the reasons independent claim 1 is patentable under 35 U.S.C. §103(a) over Dontula et al. (USPN 6,841,226) in view of Mehta et al. (USPN 6,844,389), alone or in combination.

#### **NEW CLAIMS:**

New claim 11 recites that the features of the present invention include the polyolefin resin composition according to claim 1, wherein the modified polyolefin resin is a modified polyolefin having a carboxyl group. New claim 11 is supported by paragraph [0054] of the specification. As described in paragraph [0054] of the published Patent Application No. 20050239941, a

hydrogen-bonding carboxyl modification degree (PcH) of 0.80 or more recited in claim 1 indicates that the resin composition contains a carboxyl group in a specific amount. Nothing in the prior art teaches or suggests such. It is submitted that this new claim distinguishes over the prior art.

New claim 12 recites that the features of the present invention include the polyolefin resin composition according to claim 1, wherein the modified polyolefin is a maleic acid modified polyolefin. New claim 12 is supported by paragraph [0062] of the published Patent Application No. 20050239941. As is set forth in paragraph [0062] of the published Patent Application No. 20050239941, Hi-wax™ 2203A (HW2203A) and Hi-wax™ 1105A (HW1105A) used in Examples 1 to 5 are polyolefin modified with maleic acid. Nothing in the prior art teaches or suggests such. It is submitted that this new claim distinguishes over the prior art.

#### CONCLUSION:

In accordance with the foregoing, it is respectfully submitted that all outstanding objections and rejections have been overcome and/or rendered moot, and further, that all pending claims patentably distinguish over the prior art. Thus, there being no further outstanding objections or rejections, the application is submitted as being in condition for allowance which action is earnestly solicited.

If the Examiner has any remaining issues to be addressed, it is believed that prosecution can be expedited by the Examiner contacting the undersigned attorney for a telephone interview to discuss resolution of such issues.

If there are any underpayments or overpayments of fees associated with the filing of this Amendment, please charge and/or credit the same to our Deposit Account No. 19-3935.

Respectfully submitted,

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